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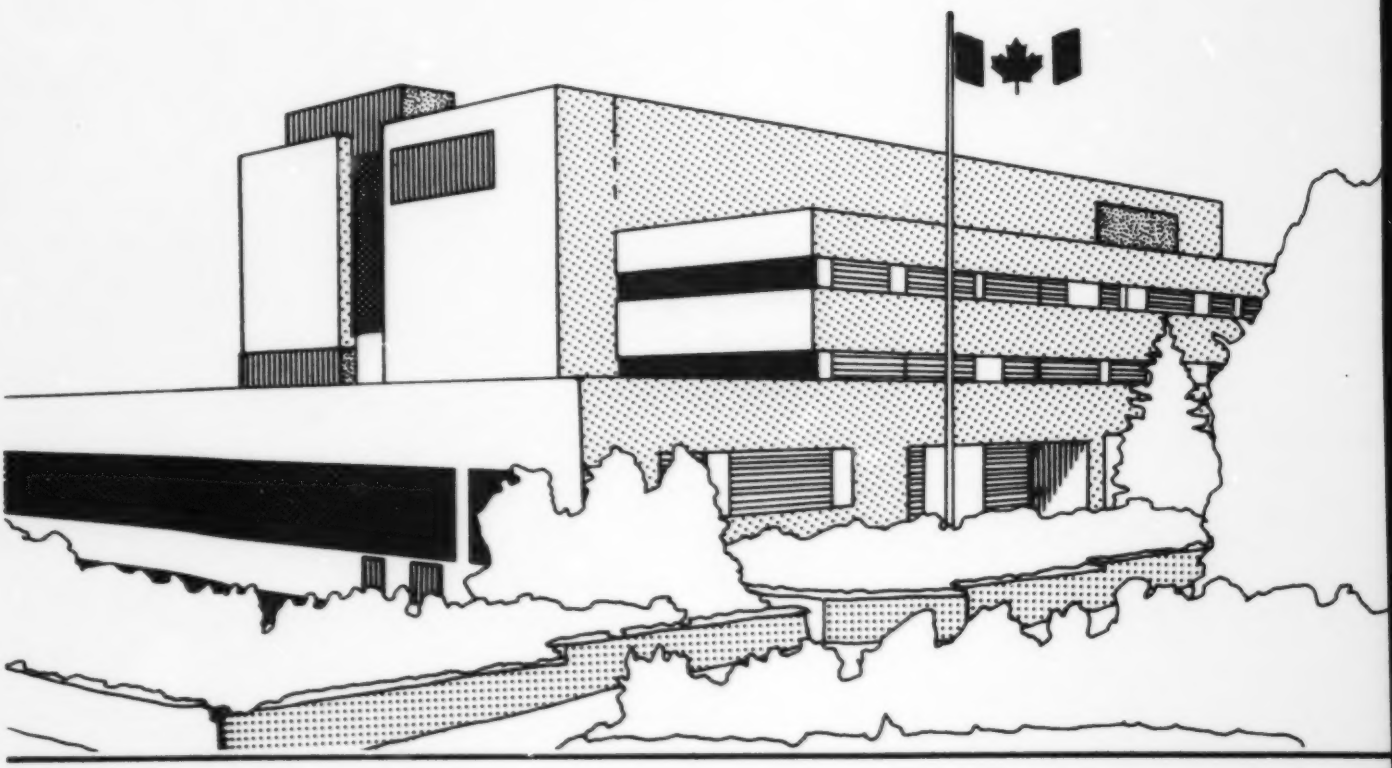
Results of forest insect and disease surveys in the SOUTHWESTERN REGION of Ontario, 1988

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

H. Broderson and W.D. Biggs
Miscellaneous Report No. 88



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RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE SOUTHWESTERN REGION OF ONTARIO, 1988

(FOREST DISTRICTS: OWEN SOUND, WINGHAM, CHATHAM AYLMER AND SIMCOE)

H. BRODERSEN and W.D. BIGGS

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1989

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SURVEY HIGHLIGHTS

This report deals with forest insects and diseases encountered in the course of regular and special surveys carried out during the 1988 field season in the Southwestern Region of Ontario. Cedar leafminer populations were largely unchanged from the previous year. The area of spruce budworm damage continued to decrease across the province. Oak leaf shredder populations decreased to endemic levels. Gypsy moth populations and damage rose significantly: several new infestations were recorded. Aerial surveys for the forest tent caterpillar revealed significant defoliation in the northern half of the Owen Sound District and white pine weevil populations shifted slightly in the region.

Scleroderris surveys were all negative and significant damage by diplodia tip blight was discovered at new locations. Forest health plots are now being monitored for several hardwood species at 20 locations throughout the region. Widespread damage from drought and winter drying was noted in 1988. Red pine was the species chosen for both the high-value-plantation survey and the cone and seed survey. The number of known locations for pinewood nematode continues to grow. The beech scale was located in Aylmer District. Climatic data and a report of nursery inspections are included in this year's report.

As in previous years, pests described in this report are categorized as follows:

Major Insects/Diseases

capable of causing severe injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

(No minor insects or diseases were reported in 1988.)

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

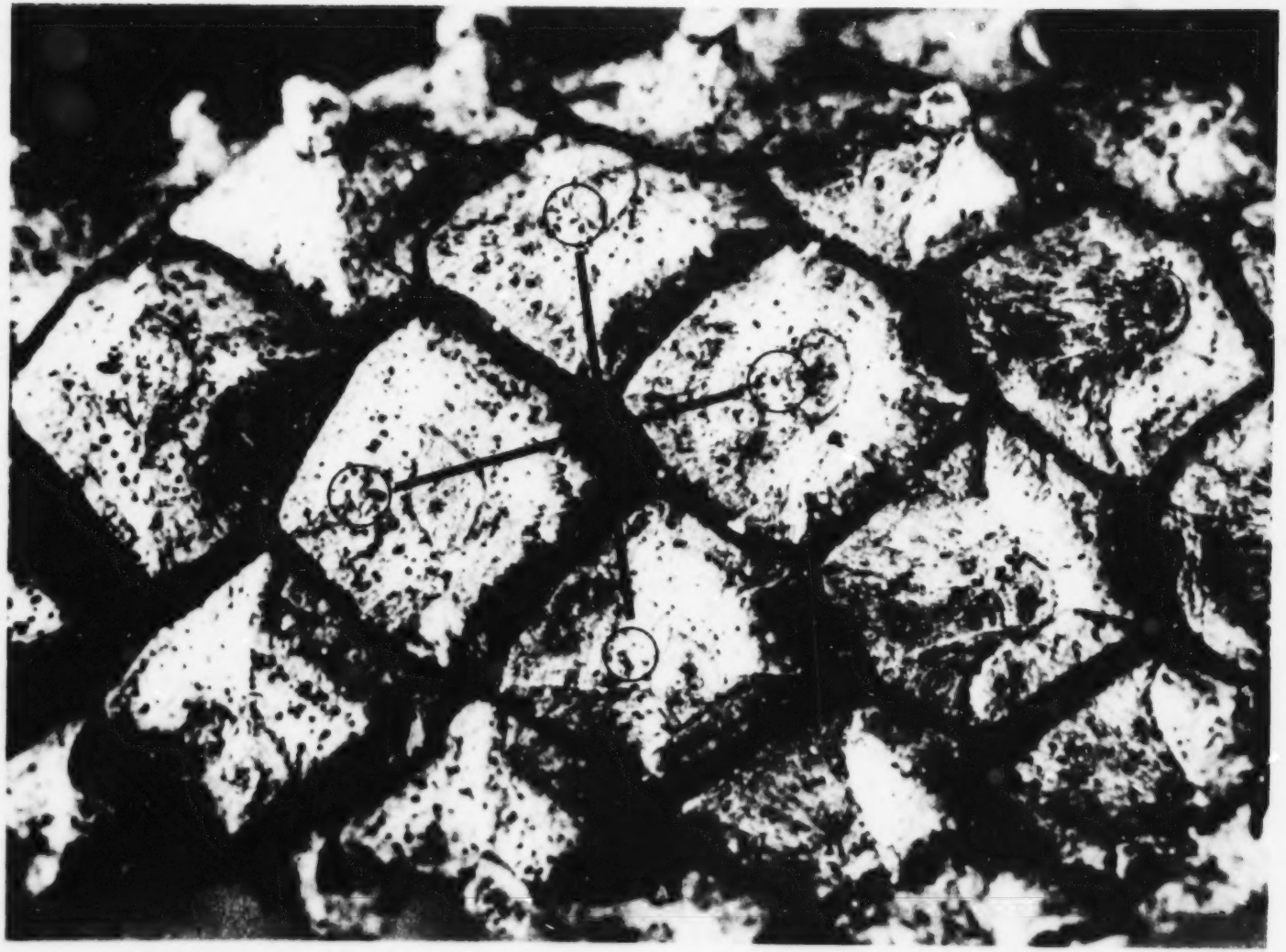
(1) those that are of minor importance and have not been known to cause serious damage to forest trees, and

(2) those that are capable of causing serious damage but have not done so because of low populations or for other reasons.

The valuable assistance and cooperation extended to the authors by the Ontario Ministry of Natural Resources during the 1988 field season are gratefully acknowledged.

H. Brodersen
W.D. Biggs

Frontispiece



Fruiting bodies (highlighted by circles) of tip blight (*Sphaeropsis sapinea* [Fr.] Dyko & B. Sutton) on a second-year Scots pine (*Pinus sylvestris* L.) cone

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INSECTS

Cedar Leafminers, **Argyresthia aureoargentella** Brower, **A. canadensis** Free., **A. thuiella** (Pack.) and **Coleotechnites thujaella** (Kft.)

Inspection of approximately 70 locations throughout 61 townships across the region confirmed that population levels varied considerably; however, with the exception of Owen Sound District, foliar damage was usually low (<10%).

Surveys across the districts of Wingham, Chatham, Aylmer and Simcoe of eastern white cedar (**Thuja occidentalis** L.) hedgerows, windbreaks and natural stands revealed that 56% of all sites examined sustained the lowest average foliar damage (4%) recorded over the previous three seasons.

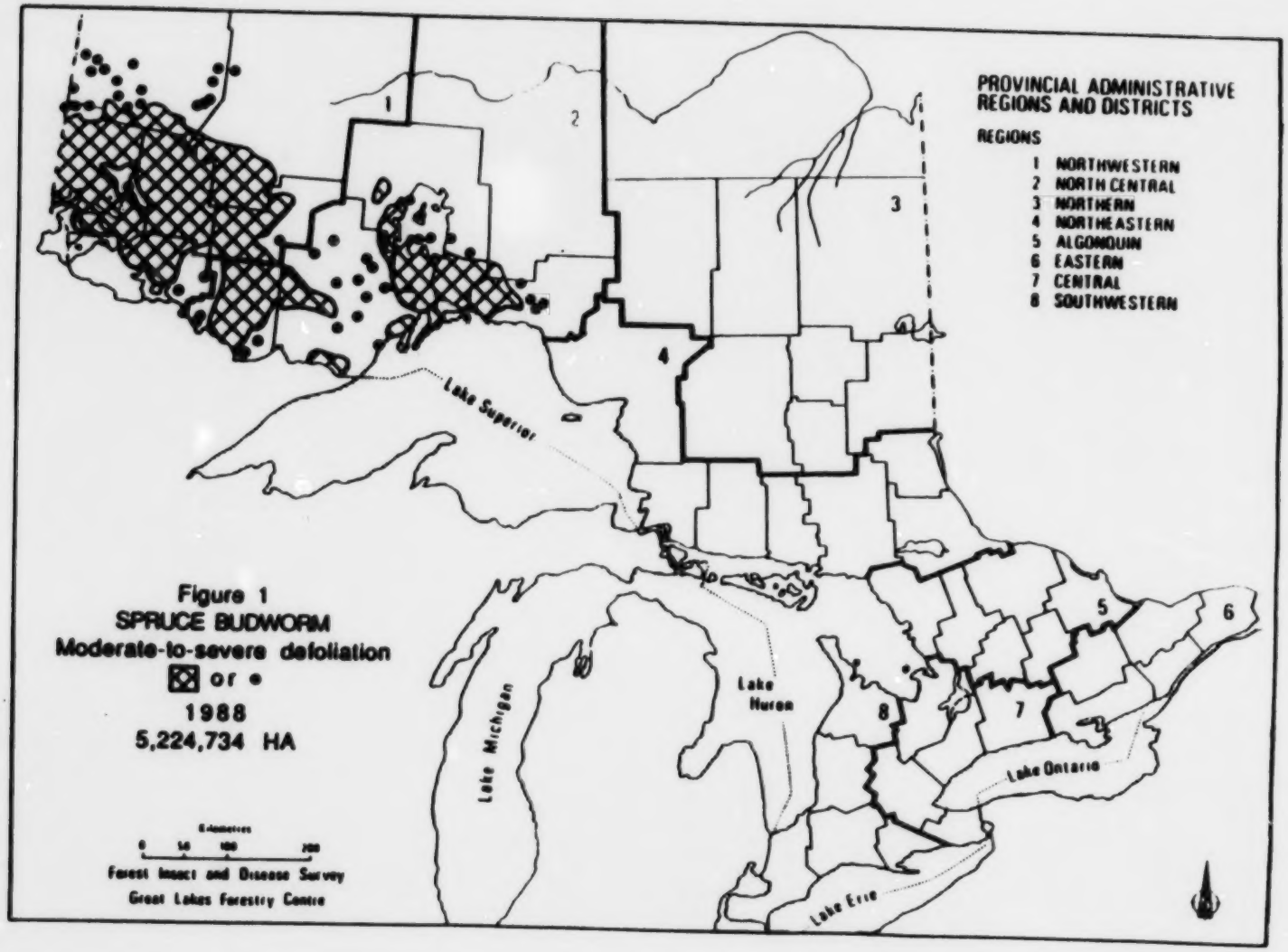
The highest percentage of examined sites affected (100%) was once again in Simcoe District; this percentage was up significantly (75%) from 1987. Foliar damage remained low (7%) on 31% of all trees at these sites. The lowest incidence of damaged sites (14%) was recorded in Chatham District, where a significant percentage of trees (40%) sustained low levels of foliar damage (8%). Similar levels of foliar damage (3%) on 26% of all trees checked typified the situation in the Aylmer and Wingham districts, where the percentage of locations attacked was 66% and 46%, respectively.

Levels of foliar damage across the Owen Sound District in 1988 were slightly higher but still in the low-to-moderate range (25-45% on average). The highest damage noted (50-70%) was throughout the traditionally infested townships of St. Edmunds, Lindsay, Eastnor and Albemarle, on the Bruce Peninsula. Throughout the central portions of the district lower levels of foliar damage (30%) were routinely encountered. Less significant levels (10-20%) were recorded in the southwestern townships, including Brant Township and eastward to Lake Huron.

Spruce Budworm, **Choristoneura fumiferana** (Clem.)

From the results of egg-mass, pheromone and damage surveys across the Southwestern Region it is predicted that budworm populations will continue to remain at endemic levels across the work area in 1989.

Across the province, budworm populations continued to decline to approximately 5,224,734 ha in 1988 (decrease of 27% in the total area of moderate-to-severe defoliation). Damage was confined exclusively to the North Central and Northwestern regions (Fig. 1). The gross area of budworm-killed balsam fir (**Abies balsamea** [L.] Mill.) in 1988 for all of Ontario now constitutes some 14,515,719 ha. This figure represents a


PROVINCIAL ADMINISTRATIVE
REGIONS AND DISTRICTS
REGIONS
1 NORTHWESTERN
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6 EASTERN
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Lake Superior
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Figure 1
SPRUCE BUDWORM
Moderate-to-severe defoliation
or
1988
5,224,734 HA
Forest Insect and Disease Survey
Great Lakes Forestry Centre

448,637-ha increase over the 1987 total, all of which occurred in the North Central and Northwestern regions.

Oak Leaf Shredder, **Croesia semipurpurana** (Kft.)

Populations of this defoliator fell to the lowest levels (endemic) recorded over the previous five years. Checks of the oak health plots located in Charlotteville and South Walsingham townships, Simcoe District, revealed that foliar damage averaged <1% across both plots.

Defoliation forecasts on the basis of egg densities, along with defoliation estimates and pheromone trapping results (from the oak health plots), are given in Table 1.

Table 1. Result of oak leaf shredder pheromone trapping and egg counts, and defoliation forecasts for Simcoe District in 1988 (five traps deployed at each location).

Township	Total no. of adults captured in 1988	Avg no. per trap in 1988	Concentration of pheromone (%)	Leaves attacked in 1988 (%)	Foliar damage in 1988 (%)	No. of eggs		Defoliation forecast for 1989
						1987	1988	
Charlotteville (Turkey Point Prov. Pk)	0	0	0.008	13	<1	2	0	Nil
South Walsingham (St. Williams Forest Station)	1	0.2	0.03	14	<1	0	0	Nil

Birch Leafminer, **Fenusa pusilla** (Lep.)

First-generation checks of white birch (**Betula papyrifera** Marsh.) throughout the Chatham, Aylmer and Simcoe districts revealed significantly higher rates of attack by this sawfly (100% in 10 of 13 townships surveyed, in comparison with an average of 59% for the same area in 1987). The corresponding amount of foliar damage on affected trees rose from the trace levels (3%) reported in 1987 to low levels (14%) in 1988. The highest documented rate of attacked ornamentals was in Chatham District, where every tree inspected sustained some level of damage.

Throughout Owen Sound District average damage levels fell to low-to-moderate (20 to 40%) for open-grown ornamentals. Birches in woodlots experienced the lowest levels of foliar damage (5-10%); on average, these were well below the levels of >75% reported in 1987.

Gypsy Moth, **Lymantria dispar** (L.)

Burlap and/or pheromone traps were deployed at 14 provincial parks in 1988. Moth captures were once again noted at all of the sites at which pheromone traps were deployed (Table 2).

Table 2. Results of gypsy moth burlap and pheromone trapping in 1988.

Location	No. of burlap traps	No. of larvae caught		No. of pheromone traps	No. of male moths caught	
		1987	1988		1987	1988
Aylmer District						
Iroquois Beach	10	0	0	2	33	30
Chatham District						
Rondeau Prov. Pk	10	0	3	2	10	13
Ipperwash	10	0	0	1	37	17
Pinery	10	0	0	2	48	37
Holiday Beach	na	na	na	1	na	11
Owen Sound District						
Craigleith	10	0	0	1	27	20
Crane River	na	na	na	2	na	20
MacGregor's Pt.	10	0	0	2	40	37
Sauble Falls	10	0	0	2	36	26
CFTA Meaford	na	na	na	10	74	88
Simcoe District						
Longpoint Prov. Pk	10	0	10	2	33	51
Selkirk Prov. Pk	10	0	17	2	48	30
Turkey Pt. Prov. Pk	10	11	120	2	49	65
Wingham District						
Points Farm	10	0	0	2	0	30

na = not applicable

The aerial survey conducted in mid-July across the Southwestern Region revealed or confirmed the presence of eight distinct pockets of moderate-to-severe defoliation on various hardwood hosts on private and crown lands involving a total of some 240 ha throughout the townships of

South Walsingham and Charlotteville, Simcoe District. The largest single infestation among these (200 ha) was centered on Lots 23-24, Concession 7 in South Walsingham Township, on private property. The remaining seven infestations had similar damage levels (25-75%) and ranged in size from 1 to 16 ha.

Gypsy moth larvae were also noted feeding on young red oak (**Quercus rubra** L.) in a planting trial at the St. Williams Forest Station, Simcoe District. Quick detection and control by nursery staff limited foliar damage to low levels (<25%).

Burlap surveys disclosed the presence of larvae at Selkirk, Long Point and Turkey Point provincial parks. (In the last-mentioned park, populations have been documented for several years.) Line searches conducted in conjunction with positive burlap finds revealed significant numbers at Turkey Point Provincial Park where 14 egg masses were found on 480 m of line; at the other two parks the line searches were negative.

First reported in 1986 on roadside bur oak (**Quercus macrocarpa** Michx.) in Dunwich Township, Aylmer District, larvae continue to be found, albeit in small numbers; to date none of the trees has sustained more than 25% defoliation. Elsewhere in Aylmer District, Ontario Ministry of Natural Resources (OMNR) and Forest Insect and Disease Survey (FIDS) personnel have reported several new egg-mass locations; (1) in the Jaffa Tract of the Springwater Conservation Area, Malahide Township, (2) in a private woodlot 1 km north of the Gore road in L10 C6 Bayham Township, and (3) in L1 C5 of the Hossack Tract, Blandford Township (the northernmost egg mass located in the district), which is administered by the Grand River Conservation Authority.

Rondeau Provincial Park personnel noted the presence of larvae for the first time in their burlap traps. Follow-up aerial and ground searches in the park revealed no further damage attributable to this pest. Elsewhere in the district significant numbers of egg masses were noted in Wheatley Provincial Park.

Downwind checks of several woodlots near which egg masses were found in 1987 in Howick Township, Wingham District failed to disclose the presence of any stage of gypsy moth.

Exclusive of the aforementioned checks, another 23 woodlots randomly located throughout the region were checked for this pest. All of these checks produced negative results. Over the previous four seasons, checks in 14 townships in the region confirmed the presence of gypsy moth (Fig. 2).

Forest Tent Caterpillar, **Malacosoma disstria** Hbn.

Defoliation by this pest was aerially mapped in Owen Sound District for the first time since the current outbreak in Ontario began.

SOUTHWESTERN REGION

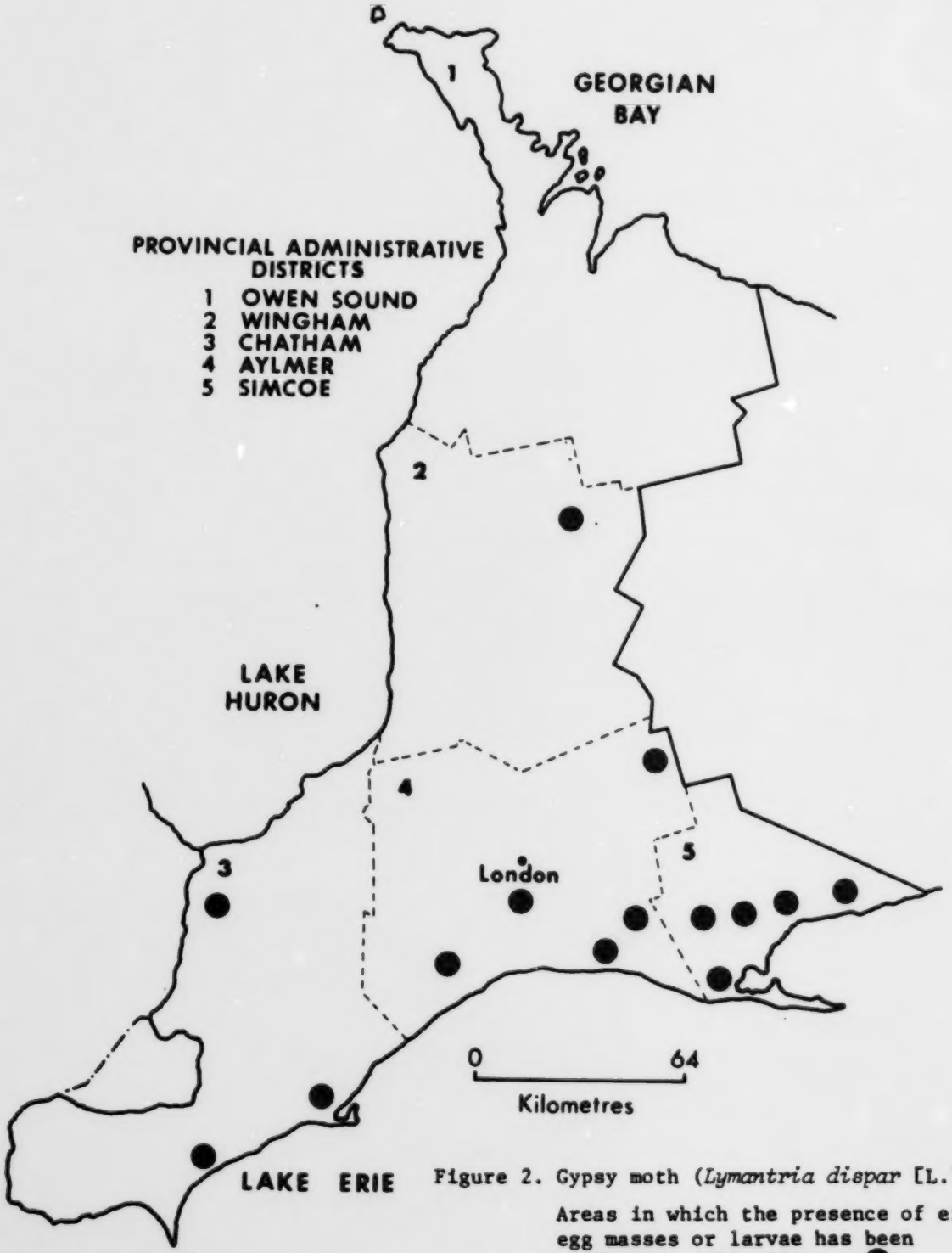

Figure 2. Gypsy moth (*Lymantria dispar* [L.])

Areas in which the presence of either egg masses or larvae has been confirmed, 1985-1988_____●

All together, 4,760 ha of moderate-to-severe (25-100%) defoliation of poplar (**Populus** spp.), oak (**Quercus** spp.) and sugar maple (**Acer saccharum** Marsh.) was mapped in the northern half of the district (Fig. 3).

The largest pockets of heavy (75-100%) defoliation were located in Keppel and Albemarle townships. Moderate defoliation was mapped in Eastnor, Sydenham, Holland, Euphrasia and Keppel townships. Larvae were found at other points in the district but not at damaging levels.

Egg-band counts undertaken at a dozen locations in and around the known infestation (Table 3) indicate that the heavy infestation in Keppel Township will persist in 1989, and moderate damage levels are expected in the southwest, toward the town of Hepworth. Both moderate and severe defoliation are forecast at various points in Holland and Sullivan townships. Light foliar damage is forecast for the townships of Collingwood, Sydenham and Derby. No significant damage by this pest was recorded elsewhere in the region.

Table 3. A summary of forest tent caterpillar egg-band counts in Owen Sound District in 1988, with infestation forecasts for 1989.

Location	Host	Avg DBH of trees (cm)	Avg no. of egg bands per tree	Infestation forecast for 1989[a]
Albemarle Twp	tA	20	1	L
Bentinck Twp	sM	30	0	N
Collingwood Twp	sM	23	1	L
Derby Twp	sM	23	4	L
Eastnor Twp	sM	20	5	L
Holland Twp	sM	30	16	S
Keppel Twp - L29 C17	sM	18	100	S
Keppel Twp - L17 C22	sM	21	51	S
Keppel Twp - L27 C2	sM	19	8	M
Sullivan Twp - L16 C2	sM	25	7	M
Sullivan Twp - L30 C2	sM	23	14	S
Sydenham Twp	sM	21	3	L

[a] N = nil, L = light, M = moderate, S = severe

White Pine Weevil, **Pissodes strobi** (Peck)

In all, 22 white pine (**Pinus strobus** L.) plantations were surveyed for weevil damage across the Wingham, Chatham, Aylmer and Simcoe districts. Insignificant population increases were noted at seven locations (Table 4) and only two plantations monitored contained more than 10% weeviled leaders.

SOUTHWESTERN REGION

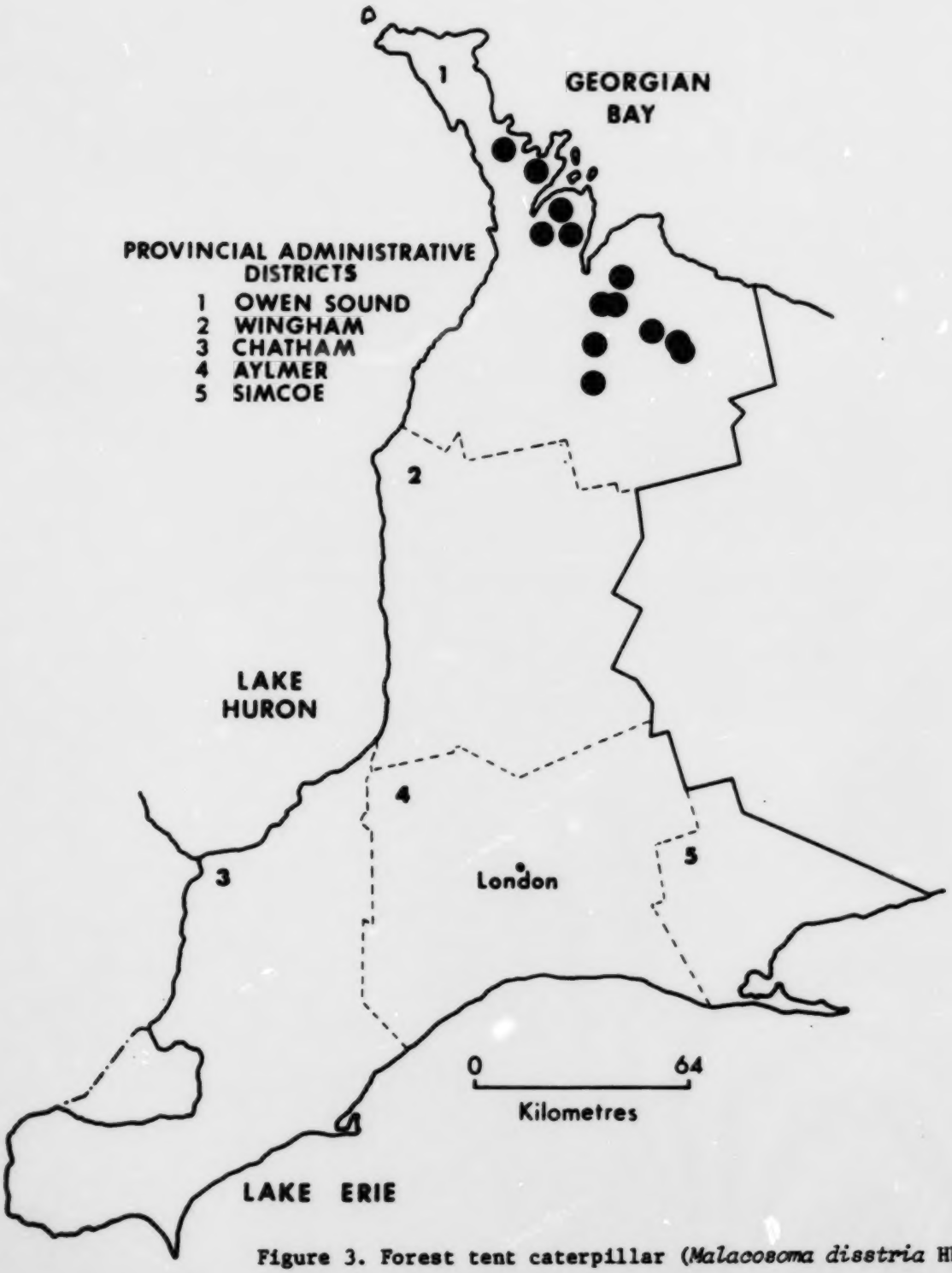

Figure 3. Forest tent caterpillar (*Malacosoma disstria* Hbn.)

Areas within which moderate-to-severe defoliation occurred in 1988 ●

Table 4. Summary of leader damage by white pine weevil in four districts in 1987 and 1988 (counts based on the examination of 100 white pine trees at each location).

Location (Twp)	Avg height of trees (m)	Approximate stocking (trees/ha)	Area affected (ha)	Leaders attacked (%)	
				1987	1988
Aylmer District					
Bayham	3.3	1,415	2.5	1	0
Delaware	3.5	2,900	13.0	0	0
Dereham	5.2	2,900	3.2	0	0
Lobo	3.0	2,375	0.6	0	0
Mosa	3.0	2,320	1.0	0	0
N. Dorchester	5.5	1,990	5.0	0	0
W. Oxford	3.7	2,990	3.0	11	14
E. Zorra	5.7	1,990	1.5	0	0
W. Zorra	5.2	2,900	1.3	0	0
Yarmouth	5.0	2,900	2.5	1	0
Chatham District					
Zone	2.5	2,990	0.8	0	1
Simcoe District					
Charlotteville	2.7	2,900	1.6	5	8
S. Walsingham	6.7	2,900	0.6	6	7
N. Walsingham	6.0	3,600	2.0	14	16
Windham	5.0	1,000	0.4	1	2
Woodhouse	5.0	1,900	3.5	3	1
Wingham District					
Blanshard	4.7	1,250	1.2	0	0
Carrick	2.7	1,990	1.2	0	0
Goderich	3.3	1,780	0.6	0	0
Hullett	4.5	1,200	50.0	0	0
Kinloss	5.0	2,900	10.0	1	4
Mornington	5.7	2,900	3.3	0	0

Table 5. Other forest insects.

Insect	Host(s)	Remarks
Bucculatrix ainsliella Murt. Oak skeletonizer	rO,wO,blO	Observations of population check plots in S. Walsingham and Charlotteville townships, Simcoe District, revealed low foliar damage levels (10%) on 100% of all trees examined.
Cameraria hamadryadella (Clem.) Solitary oak leafminer	bO	noted at low damage levels (20%) on 100% of regeneration inspected in a 1.5-ha woodlot in C4 L12, Delaware Township, Aylmer district
Cryptococcus fagisuga Linding. Beech scale	Be	Trace numbers of scale insects were detected on the boles of several mature woodlot trees in L4 C3, Bayham Township, Aylmer District.
Dasychira spp. A tussock moth	ScP	Early-instar larvae were noted feeding on 80% of all 1.5-m-tall trees in a 1-ha Christmas tree plantation in L5 C4, S. Walsingham Township, Simcoe District. Only trace levels of foliar damage (<3%) were detected prior to chemical control.
Datana integerrima G. & R. Walnut caterpillar	bWa	A survey of randomly located roadside trees across the Chatham, Aylmer and Simcoe districts revealed low levels of defoliation (8%) on 51% of all trees examined.
Hyphantria cunea (Drury) Fall webworm	Wa and various hardwoods	There were generally few web masses across the region. A single exception was along Hwy 59 in Charlotteville Township, Simcoe District, where the significant numbers reported last year increased to more than 50 webs/km. Foliar damage remained unchanged, at low levels (10% on average).

TREE DISEASES

Major Diseases

Scleroderris Canker, **Ascocalyx abietina** (Lagerb.) Schläpfer-Bernhard

In all, 32 red pine (**Pinus resinosa** Ait.) and three Scots pine (**Pinus sylvestris** L.) plantations across the region were checked for both the North American and the European race of Scleroderris canker. All of these checks, conducted in a total of 15 townships (Fig. 4), yielded negative results.

Diplodia Tip Blight, **Sphaeropsis sapinea** (Fr.) Dyko & B. Sutton

A significant infection by this disease was evaluated in a private plantation in the southern portion of Lot 22, Concession 7, North Walsingham Township, Simcoe District. The average diameter of the Scots pine in this plantation was 23 cm. The survey revealed that 83% of all trees had an average of 35% crown damage, and whole-tree mortality was 9%.

Table 6. Other forest diseases.

Organism	Host(s)	Remarks
Heterobasidion annosum (Fr.) Bref. Fomes root rot	rP	A small pocket (<1 ha) of 20-m-tall plantation trees east of the Gibson side road at the St. Williams Forest Station, Simcoe District, sustained 25% tree mortality.
Hypoxylon deustum (Hoffm.:Fr.) Grev. Hypoxylon canker	sM	A single main-stem canker was noted on an over-mature tree on the Springwater Creek Conservation Forest Trail, Malahide Township, Aylmer District.
Verticillium sp. Verticillium wilt	rM	A single occurrence of whole-tree mortality, of a mature ornamental, was noted at a private residence in the town of Innerkip, Aylmer District.

SOUTHWESTERN REGION

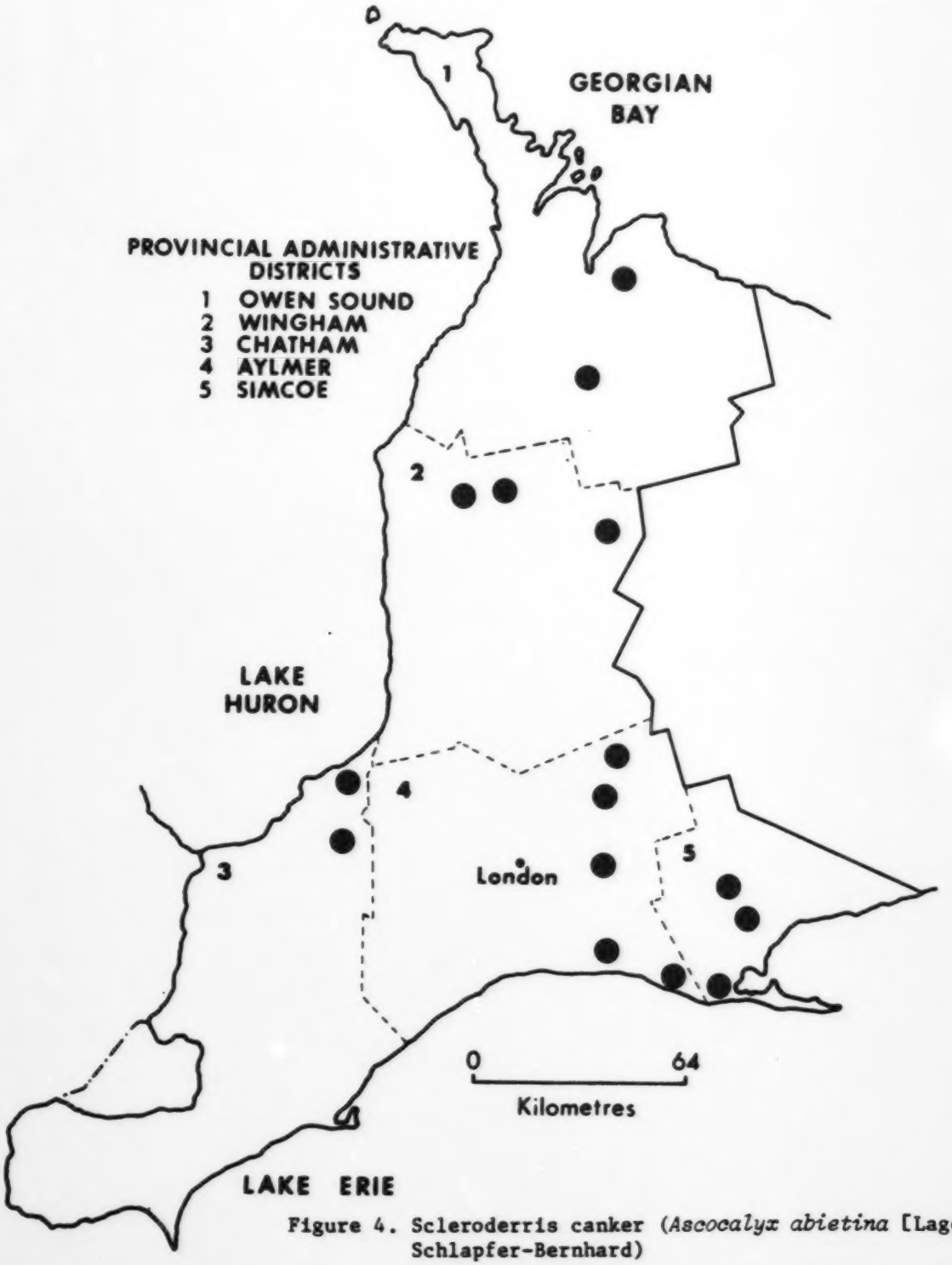

Figure 4. Scleroderris canker (*Ascocalyx abietina* [Lagerb.] Schlapfer-Bernhard)

Areas in which one or more locations were checked for both races (North American and European) in 1988. (All results were negative.)

FOREST HEALTH

Oak Health

Crown conditions on three oak plots monitored over the previous 12 summers (1976-1988) are summarized in Table 7. Surveys conducted in 1988 for foliar and non-foliar pests revealed no significant damage in any of the plots. Significant rainfall deficits during the previous two springs, however, are no doubt having a pronounced effect on tree vigor.

Maple Health

The 10 sugar maple study plots established across the region in 1987 (Fig. 5, Table 8) were re-examined in 1988. No significant pests or damage were noted at any of the sites. Four crown-class shifts in the tables were documented; two of them were due to the inadvertent cutting of one tree, one was a case of wind snap (as a result of canker) at the Warwick Township location in Chatham District, and the fourth was due to crown deterioration. Eutypella canker accounted for the additional damage noted in Plympton Township, also in Chatham District. A shift in crown class was noted at the Sullivan Township location in Owen Sound District; in this case, however, no apparent cause was discernible.

North American Sugar Maple Project

Concern about the health of sugar maple in the United States and Canada resulted in a cooperative agreement between the United States Forest Service and Forestry Canada to determine the rate of change in sugar maple trees from 1988 through 1990. Stands located in undisturbed forest and in sugar bushes were established in various pollution zones, in which various rates of initial decline were occurring.

Across Ontario 24 such plots were established; seven of these are in the Southwestern Region (Fig. 6). Stand selection was limited to those stands in which more than 50% of the dominant and codominant trees were 50-150 years old. Table 9 summarizes the condition of the stands examined, by percentage of dead crown.

Table 7. Summary of oak health at three locations in the Southwestern Region of Ontario (100 red and/or white oak trees examined at each location).

Location (Twp)	Avg DBH of sample trees (cm)	Area affected (ha)	Year	Total dead crown (%) 0-20	21-40	41-60	>60	No. of dead trees
				- - - No. of trees - - -				
Simcoe District								
Charlotteville	32	315	1977	70	8	12	10	0
			1978	69	9	10	12	0
			1979	58	14	19	8	1
			1980	29	37	25	8	1
			1981	25	41	30	3	1
			1982	23	50	25	1	1
			1983	23	54	21	1	1
			1984	79	16	2	2	1
			1985	88	6	2	3	1
			1986	93	3	2	1	1
			1987	91	4	2	1	2
			1988	88	8	1	1	2
South Walsingham	22	150	1977	42	35	18	5	0
			1978	40	33	19	4	4
			1979	36	38	16	3	6
			1980	29	38	22	5	6
			1981	19	41	29	1	9
			1982	19	52	18	1	9
			1983	19	50	20	2	9
			1984	72	23	5	1	9
			1985	97	3	0	0	10
			1986	99	0	0	1	10
			1987	98	1	0	0	11
			1988	95	3	0	1	11
Chatham District								
Bosanquet	29	2,542	1977	69	7	17	7	0
			1978	69	7	17	7	0
			1979	68	11	16	5	0
			1980	53	19	21	7	0
			1981	48	24	21	7	0
			1982	49	38	9	2	2
			1983	35	39	20	4	2
			1984	80	12	2	2	4
			1985	85	3	3	4	5
			1986	90	1	0	2	7
			1987	89	0	1	3	7
			1988	86	0	2	5	7

SOUTHWESTERN REGION

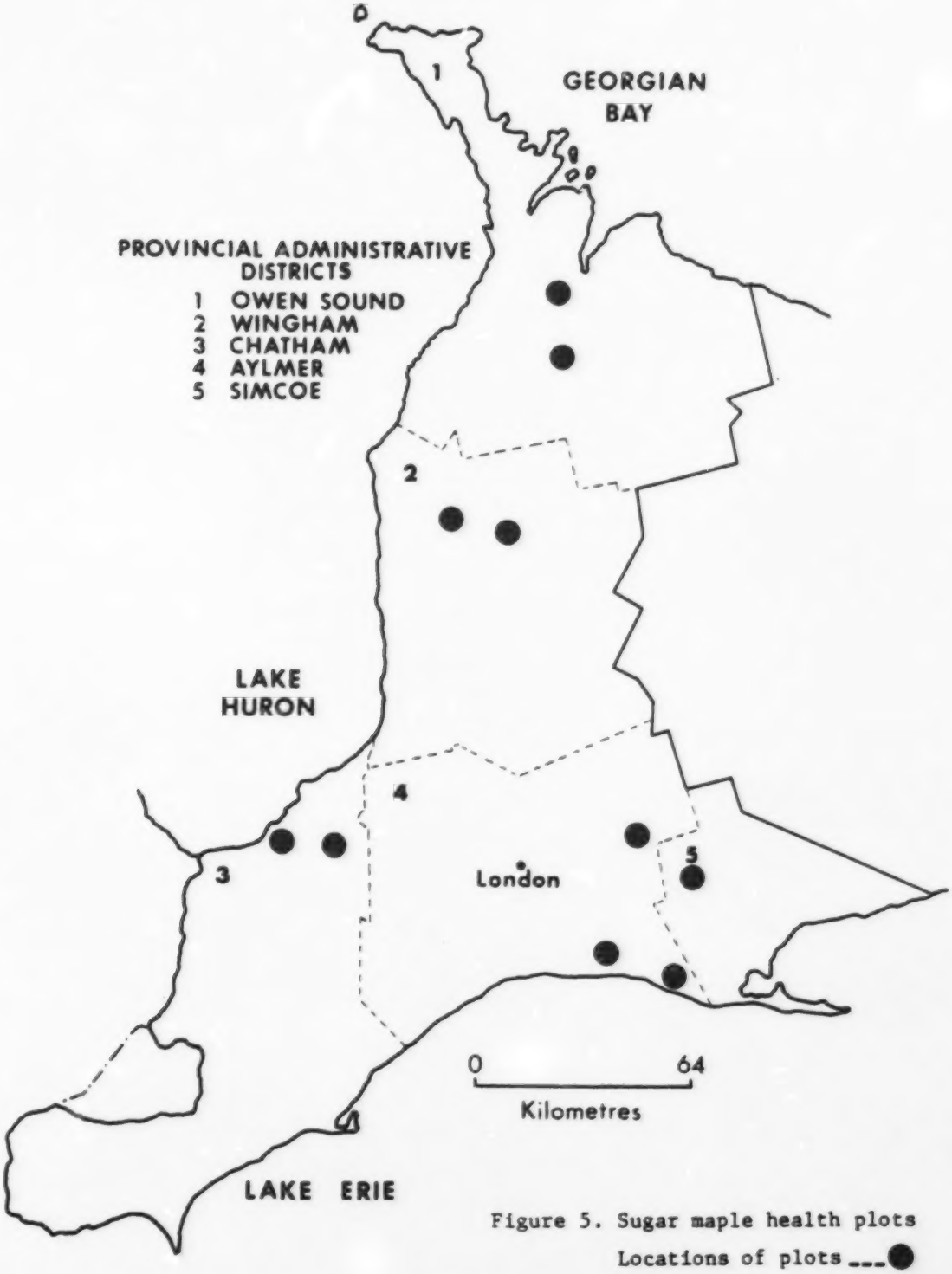

Figure 5. Sugar maple health plots

Locations of plots ---●

Table 8. Summary of maple health at 10 locations in the Southwestern Region of Ontario (25 sugar maple trees examined at each location).

Location (Twp)	Avg DBH of sample trees (cm)	Year	Total of dead crown (%)					No. of dead trees
			0-5	6-20	21-40	41-60	>60	
			- - - - No. of trees - - - -					
Aylmer District								
Malahide	35.3	1987	25	0	0	0	0	0
		1988	25	0	0	0	0	0
West Oxford	27.1	1987	25	0	0	0	0	0
		1988	25	0	0	0	0	0
Chatham District								
Plympton	29.3	1987	24	1	0	0	0	0
		1988	23	2	0	0	0	0
Warwick	31.3	1987	24	1	0	0	0	0
		1988	22	1	0	0	1	1
Owen Sound District								
Derby	31.6	1987	25	0	0	0	0	0
		1988	25	0	0	0	0	0
Sullivan	42.2	1987	25	0	0	0	0	0
		1988	24	1	0	0	0	0
Simcoe District								
Houghton	33.3	1987	25	0	0	0	0	0
		1988	25	0	0	0	0	0
N. Norwich	31.0	1987	25	0	0	0	0	0
		1988	25	0	0	0	0	0
Wingham District								
Morris	29.5	1987	25	0	0	0	0	0
		1988	25	0	0	0	0	0
W. Wawanosh	30.3	1987	25	0	0	0	0	0
		1988	25	0	0	0	0	0

SOUTHWESTERN REGION

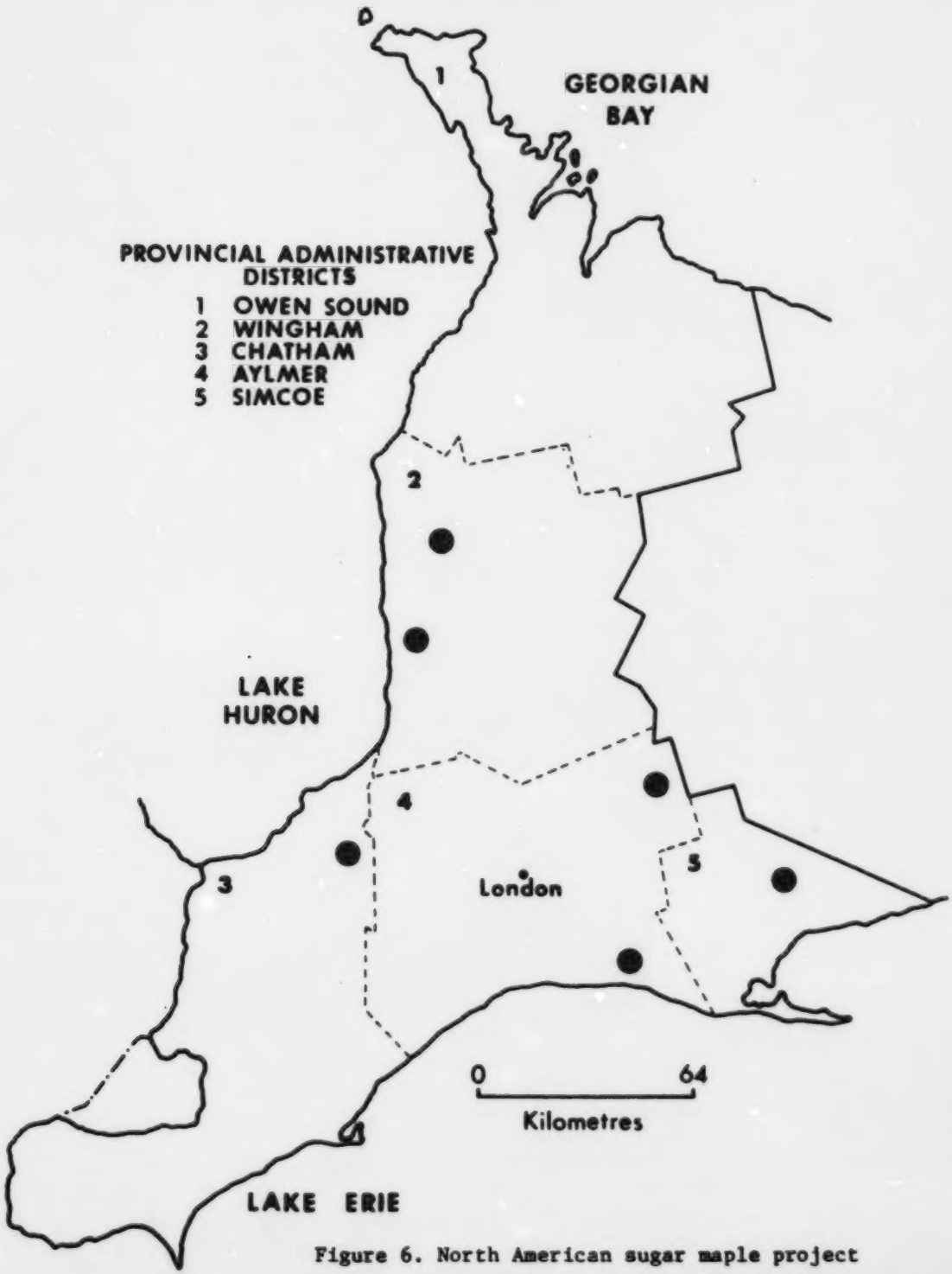

Figure 6. North American sugar maple project
Locations of plots established in 1988 ---●

Table 9. Summary of North American Sugar Maple Project in 1988 at six locations in the Southwestern Region of Ontario.

Location (Twp)	Avg DBH of sample trees (cm)	Total of dead crown (%)												Total no. of trees examined
		0	1-5	6-15	16-25	26-35	36-45	46-55	56-65	66-75	76-85	86-95	96-100	
		No. of trees												
Chatham District														
Warwick	26.5	37	8	0	3	0	0	0	0	0	0	0	0	48
Aylmer District														
Blandford	29.8	29	10	3	0	0	0	0	0	0	0	0	0	42
Bayham	73.5	2	16	1	1	1	0	0	0	0	0	0	0	22
Wingham District														
W. Wawanosh	29.9	14	20	2	0	0	0	0	0	0	0	1	0	36
Goderich	32.3	23	29	6	1	0	0	1	0	0	0	0	1	61
Simcoe District														
Townsend	41.1	15	8	3	2	2	1	0	1	0	0	0	0	32
Owen Sound District														
Saugeen	30.8	38	1	1	0	0	0	0	0	0	0	0	0	44

ABIOTIC DAMAGE

Drought

The shortages of rainfall this spring accounted for widespread damage, which manifested itself in various forms at many locations across the region.

Small pockets (<0.1 ha) of woodlot trees sustained moderate-to-severe levels (25-100%) of foliar damage in many areas. Typically, 12-18 sugar maple and beech (**Fagus** spp.) trees were damaged. This drought problem was aggravated by wind conditions as the damage was frequently noted on the windward side of affected woodlots.

Significant damage occurred to eastern white cedar (**Thuja occidentalis** L.) windbreaks in the townships of Mersea, Chatham, Warwick and Raleigh in Chatham District. Affected windbreaks suffered various levels of desiccation and whole-tree mortality. In three of the worst instances 70% of the trees examined averaged 60% defoliation. This phenomenon was noted at numerous locations across the region.

The worst example of drought in a plantation was recorded in a 40-ha plantation of mixed red and white pines in the northern half of Lot 10, Concession 9 in Charlotteville Township, Simcoe District. Here, a 0.5-ha pocket of 20-m-tall trees experienced drought damage combined with damage by the pine engraver beetle [**Ips pini** [Say]), and about 50 of the trees were dead.

The most visible drought damage was on already-stressed roadside sugar maple and silver maple, (**Acer saccharinum** L.) trees. Clumps of about 12-18 trees showed widely varying rates of foliar damage (5-75%) at numerous locations across the region.

Ornamentals of various species (usually <4 m tall) were recorded as dead or moribund in numerous towns throughout the region. White birch, (**Betula papyrifera** Marsh.) was the species most often noted to be suffering from lack of moisture.

Trees may be killed outright by drought, but more often a portion of the root system dies. This becomes evident in subsequent years as twig and branch mortality; such weakened trees are more predisposed to attacks by secondary insects and fungi, which may contribute to the death of the tree. Marginal conifers may dry out completely if severe winter drying persists after drought damage. Shorter internodes may also be evidence of the dry spring weather some conifers have been forced to endure over the previous two years.

Winter Drying

The combined effects of winter drying and lack of rain early in spring accounted for significantly higher numbers of damaged eastern

white cedar hedgerows and windbreaks across the region. Foliar damage, however, remained low (6%-25%). Table 10 lists the results of some 56 checks in nearly as many townships.

Table 10. Summary of the results of the winter-drying survey of eastern white cedar windbreaks and hedgerows in four districts of the Southwestern Region of Ontario.

	Sites with damage (%)		Trees affected at damaged sites (%)		Foliar damage at affected sites (%)	
District	1987	1988	1987	1988	1987	1988
Wingham	66	93	61	34	9	7
Chatham	41	88	34	19	7	3
Aylmer	41	92	29	41	2	9
Simcoe	45	75	56	35	6	6

SPECIAL SURVEYS

Red Pine Plantation Survey

The annual plantation survey designed to highlight historically important pests focused on pests of red pine in 1988. The results are summarized in Table 11.

Seven plantations across five districts (Fig. 7) were surveyed on two separate occasions to allow for the occurrence of specific pests, as some arrive earlier than others. The first survey took place in the third week of June and the second in the fourth week of July. Two plantations were surveyed in the 0-2 m height class, three in the 2-6 m class and two in the >6 m class.

Major forest pests checked for but not encountered included: the European pine sawfly (**Neodiprion sertifer** [Geoff.]), the pine root collar weevil (**Hylobius radicis** Buch.), the redheaded pine sawfly (**Neodiprion lecontei** [Fitch]) and the pine false webworm (**Acantholyda erythrocephala** [L.]).

No fungal diseases were encountered during the survey; however, significant abiotic damage in the form of drought was noted in two plantations.

Table 11. Summary of the results of a red pine survey carried out at seven locations in the Southwestern Region of Ontario in 1988.

Location (Twp)	Estimated stocking (trees/ha)	Avg ht of sample trees (m)	European pine shootmoth		Cinara aphids		Pine needle scale		Drought	
			Trees attacked (%)	Total foliar damage (%)	Trees attacked (%)	Total foliar damage (%)	Trees attacked (%)	Total foliar damage (%)	Trees damaged (%)	Total foliar damage (%)
Aylmer District										
E. Missouri	1,550	1.7	56	3	0	0	0	0	3.3	100
Chatham District										
Warwick	2,800	2.9	0	0	100	5	0	0	0	0
Owen Sound District										
Sydenham	3,500	4.7	0	0	0	0	0	0	0	0
Simcoe District										
Charlottaville	1,300	16.0	0	0	0	0	100	5	0	0
Houghton	2,800	0.9	78.6	5	0	0	0	0	15.3	100
Windham	2,800	16.0	0	0	0	0	0	0	0	0
Wingham District										
Kinloss	2,750	5.1	0	0	40	5	0	0	0	0

SOUTHWESTERN REGION

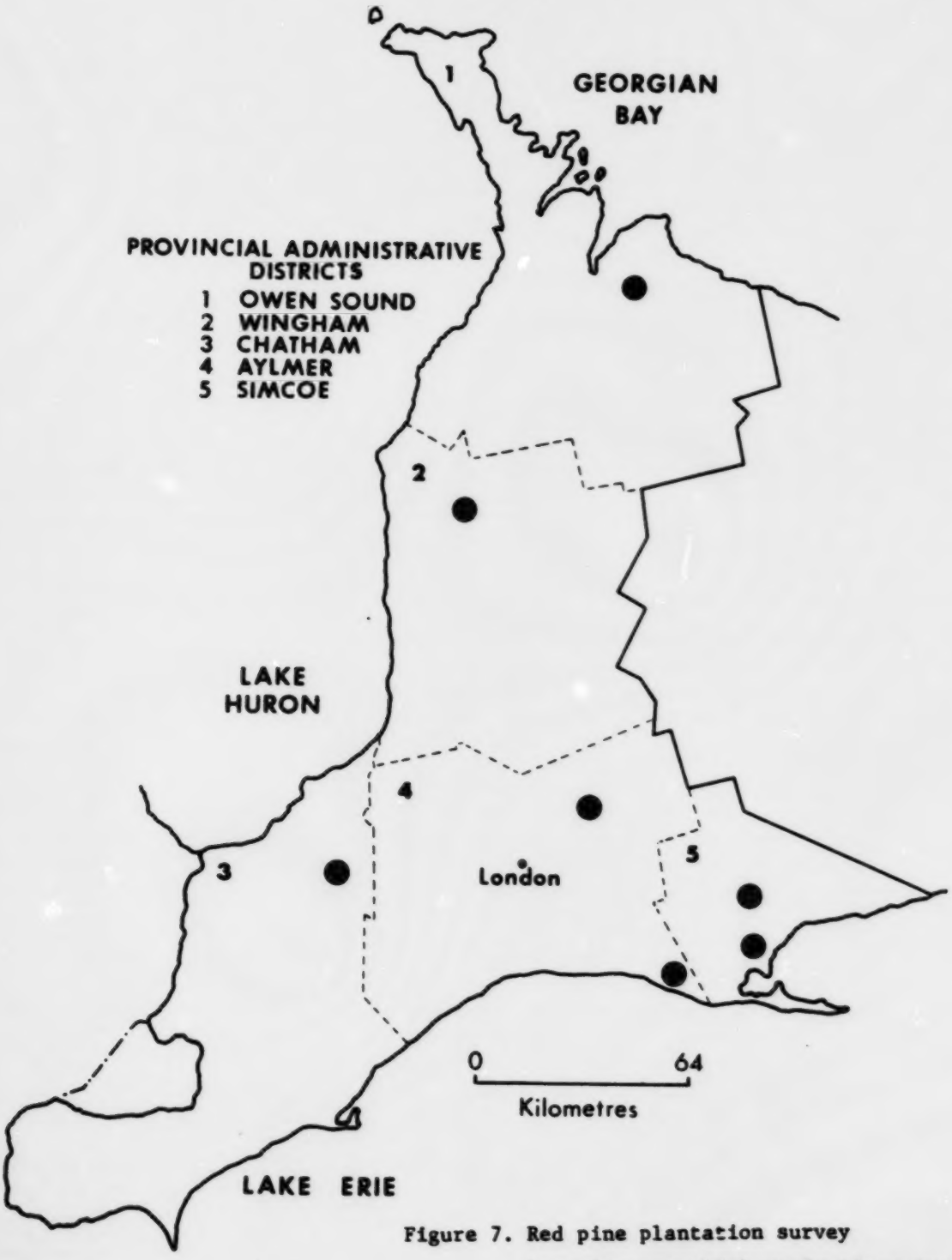

Figure 7. Red pine plantation survey

Locations at which evaluations were conducted in 1988------●

Red Pine Cone and Seed Survey

Red pine was the species chosen for assessment of the impact of pests on cones and seeds in 1988. A collection of 100 hard, green cones was submitted for inspection in the first half of July from a 10-m-tall hedgerow located on the picnic grounds of the Springwater Creek conservation area in Malahide Township, Aylmer District. Of the cones examined, 58% were damaged, with an average seed loss of 38%. The responsible agent could not be determined in approximately half (53%) of the cones with seed loss. The balance of the damage was caused by a combination of unknown Lepidoptera (13%), a midge (**Resseliella** sp.) (14%) and the eastern pine seedworm (**Cydia toreuta** [Grt.]) (19%).

Beech Bark Disease

Five randomly selected stands containing a significant beech component were inspected and documented for follow-up checks. Three of these locations were in Aylmer District, one in Simcoe District and one in Wingham District. No evidence of either the disease or the beech scale, the suspected vector, was found at any of the locations examined.

Acid Rain National Early Warning System (ARNEWS)

This summer marked the fourth consecutive year that the ARNEWS plots located in the West Wawanosh Township, Wingham District and Howard Township, Chatham District have been monitored for dieback (Fig. 8). The plot located in South Walsingham Township, Simcoe District has been monitored for three consecutive years.

Table 12 has been prepared to offer an insight into the condition of two species of hardwoods (sugar maple and oak) in these plots. No assumption was made with respect to the impact of acid rain, as processing of field data is far from complete; however, the information is offered to help in the formulation of an overview of the condition of certain hardwood stands in the Southwestern Region.

Figure 9 shows the locations of all forest health plots established by FIDS field staff to date.

St. Williams Forest Station

Routine monthly examinations conducted from May through September disclosed, among other things, that cedar leafminer populations were present in all windbreaks checked (10), and the foliar damage was low (5%) on 47% of all trees rated. Larch casebearer (**Coleophora laricella** [Hbn.]) was noted on larch (**Larix** spp.) in windbreaks at several locations; foliar damage varied widely (5-75%). During the first week of June early-instar gypsy moth larvae were observed feeding on 1-0 red oak stock in compartment A8. Quick action by nursery staff limited defoliation to low levels (<25%).

Table 12. Summary of hardwood health at three Acid Rain National Early Warning System plots established in the Southwestern Region of Ontario.

Location (Twp)	Species	Avg DBH of sample trees (cm)	Year	Tree condition: Total number of trees represented by crown class[a] 1	2	3	4	5	6	7	8	9	Total trees examined
Wingham District													
W. Wawanosh	sM	41.1	1985	7	0	0	7	0	0	0	0	1	15
			1986	7	0	0	7	0	0	0	0	1	15
			1987	6	0	0	7	0	1	0	0	1	15
			1988	6	0	4	3	0	0	1	0	1	15
Chatham District													
Howard	sM	36.3	1985	3	0	0	6	0	0	0	0	0	9
			1986	3	0	0	6	0	0	0	0	0	9
			1987	3	0	0	6	0	0	0	0	0	9
			1988	2	0	5	2	0	0	0	0	0	9
Simcoe District													
S. Walsingham	Oak	27.8	1986	1	0	4	7	4	0	0	0	0	16
			1987	0	0	2	12	2	0	0	0	0	16
			1988	1	0	3	11	1	0	0	0	0	16

[a] Crown classes:
1 = normal healthy tree
2 = foliage thin, off-color, particularly in upper crown, no bare twigs or branches
3 = dead twigs present but no dead branches. Dead twigs occur at the ends of branches, usually in the top of the crown and for a distance of about 0.5 to 1.0 m from the edge of the crown. In this and subsequent categories the foliage is usually, but not necessarily weak.)
4 = dead branches present on up to 25% of the crown
5 = dead branches present on up to 50% of the crown
6 = >50% of the crown dead but some living branches still present on the tree
7 = >50% of the crown dead; no living branches present on the tree
8 = new dead tree
9 = old dead or old missing

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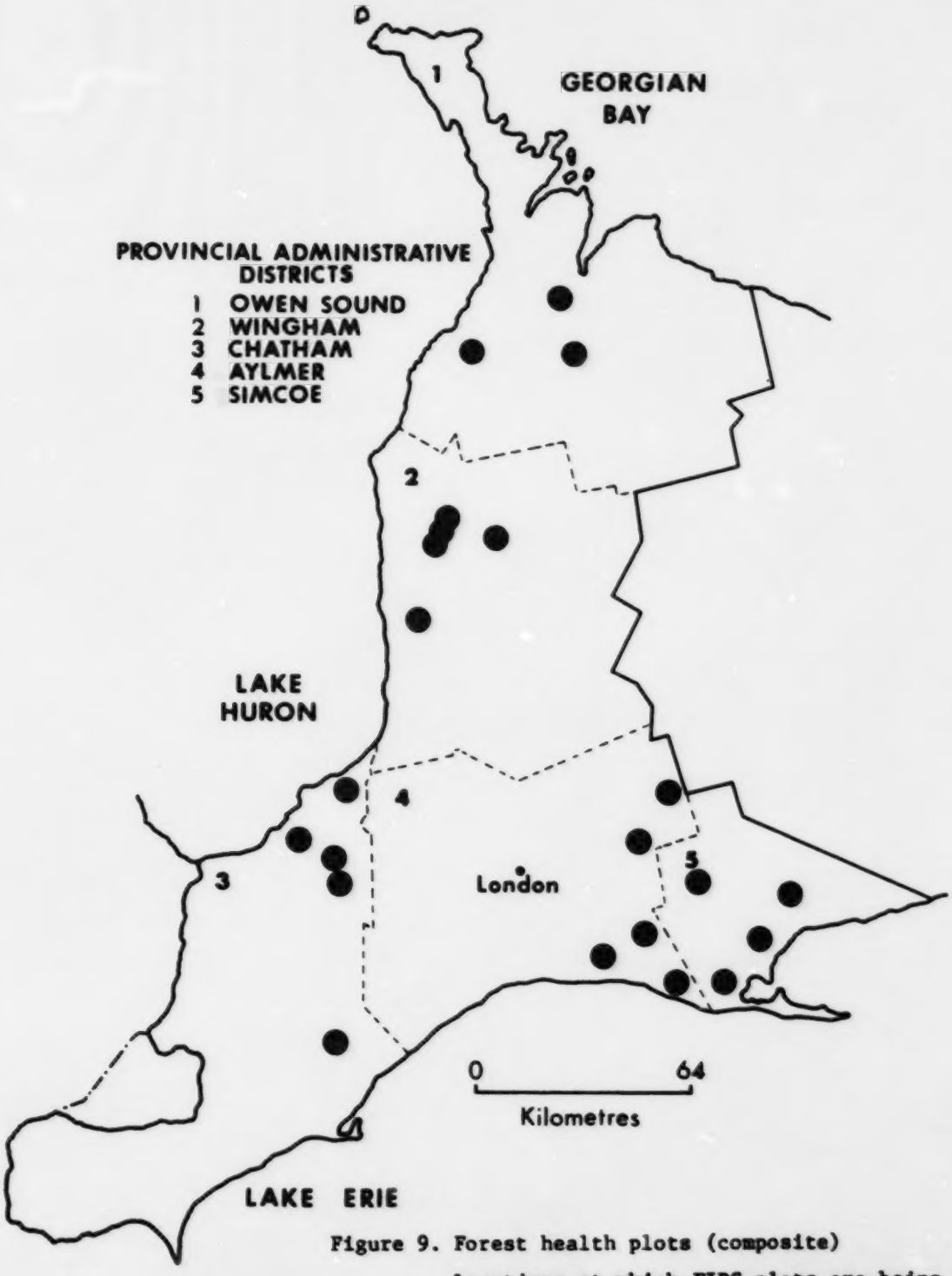

Figure 9. Forest health plots (composite)

Locations at which FIDS plots are being monitored annually to determine the current condition of the trees_____ ●

Climatic Data

Forest insects and diseases, during times critical to their development, can be greatly influenced by prevailing weather conditions. Baseline data (Table 13) are included in this report and may help in explaining variations in pest population levels and the severity of outbreaks. Data were supplied by the Atmospheric Environment Service, Department of the Environment.

Table 13. Summary of mean temperatures and total precipitation at two locations in the South-western Region of Ontario in 1988.

		Mean temperature			Total precipitation		
Location	Month	Normal[a] (°C)	Actual (°C)	Deviation from normal (°C)	Normal[a] (mm)	Actual (mm)	Deviation from normal (mm)
Blyth	Jan.	-7.9	-6.5	+1.4	105.8	124.4	+18.6
	Feb.	-8.2	-7.7	+0.5	67.2	161.4	+94.2
	Mar.	-2.8	1.5	+1.3	62.7	74.5	+11.8
	Apr.	5.1	6.2	+1.1	71.9	77.2	+5.3
	May	11.8	13.7	+1.9	73.7	76.0	+2.3
	June	17.0	16.8	-0.2	75.0	17.5	-57.5
	July	19.7	22.6	+2.9	76.6	62.7	-13.9
	Aug.	18.8	21.3	+2.5	96.3	93.0	-3.3
	Sept.	15.1	15.5	+0.4	88.4	138.5	+50.1
	Oct.	8.7	6.5	-2.2	90.3	195.5	+105.2
	Nov.	2.5	4.7	+2.2	101.4	136.5	+35.1
	Dec.	-4.3	-3.4	+0.9	116.2	55.2	-61.0
London Airport	Jan.	-6.6	-5.3	+1.3	75.2	34.5	-40.7
	Feb.	-6.1	-6.5	-0.4	60.5	67.0	+6.5
	Mar.	-0.9	-0.4	+0.5	75.1	49.3	-25.8
	Apr.	6.4	6.6	+0.2	81.2	62.4	-18.8
	May	12.4	14.5	+2.1	66.9	73.5	+6.6
	June	17.9	18.1	+0.2	73.6	9.6	-64.0
	July	20.3	22.7	+2.4	72.4	120.2	+47.8
	Aug.	19.5	21.2	+1.7	80.3	114.7	+34.4
	Sept.	15.4	15.4	0.0	78.6	61.9	-16.7
	Oct.	9.4	6.7	-2.7	73.4	138.3	+64.9
	Nov.	3.1	4.6	+1.5	84.7	116.3	+31.6
	Dec.	-3.5	-2.8	+0.7	87.5	74.4	-13.1

[a] Normal temperature and precipitation are calculated from data for the period 1930-1980.